PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : A61M 15/00 — A1

(11) International Publication Number: WO 97/47346

(43) International Publication Date: 18 December 1997 (18.12.97)

(21) International Application Number: PCT/US97/09301

(22) International Filing Date: 10 June 1997 (10.06.97)

(30) Priority Data:
08/661,212 10 June 1996 (10.06.96) US

(71) Applicant: SARNOFF CORPORATION [US/US]; 201 Washington Road, CN5300, Princeton, NJ 08543-5300 (US).

(72) Inventors: SUN, Hoi, Cheong, Steve; 3-09 Phesant Hollow Drive, Plainsboro, NJ 08536 (US). SINGH, Bawa; 12 Whyte Drive, Voorhees, NJ 08043 (US). RIVENBURG, Howard, Christopher; 16 Fontayne Court, Princeton, NJ 08543 (US). DATTA, Pabitra; 9 Yaeger Road, Cranbury, NJ 08512 (US).

(74) Agents: SILVERIO, John, V. et al.; Sarnoff Corporation, 201 Washington Road, CN5300, Princeton, NJ 08543-5300 (US).

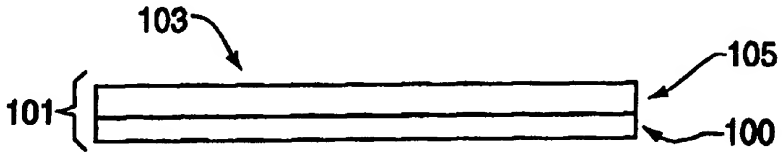
(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, UZ, VN, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

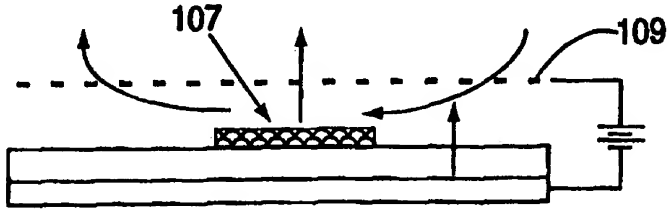
Published
With international search report.

(54) Title: INHALER APPARATUS WITH AN ELECTRONIC MEANS FOR ENHANCED RELEASE OF DRY POWDERS

(57) Abstract

The device is directed to an inhaler with a substrate (101) having a medicament (107) deposited thereon. The device further contains a conductive layer (100) and a dielectric layer (103).





FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

INHALER APPARATUS WITH AN ELECTRONIC MEANS FOR ENHANCED RELEASE OF DRY POWDERS

Related Co-Pending U.S. Patent Applications

Related co-pending U.S. patent applications, "Inhaler Apparatus with Modified Surfaces for Enhanced Release of Dry Powders," filed simultaneously herewith, Serial Nos. 08/630,049 ("Acoustic Dispenser," filed April 9, 1996, and its continuation-in-part filed simultaneously herewith), 08/630,050 ("Electrostatic Chucks," filed April 9, 1996) and its continuation-in-part, filed simultaneously herewith, 08/630,012 ("Chucks and Methods for Positioning Multiple Objects on a Substrate," filed April 9, 1996), 08/471,889 ("Methods and Apparatus for Electronically Depositing a Medicament Powder Upon Predefined Regions of a Substrate," filed June 6, 1995, and continuation-in-part thereof filed June 6, 1996), 08/467,647 ("Apparatus for Electrostatically Depositing and Retaining Materials Upon a Substrate," filed June 6, 1995) and 08/506,703 ("Inhaler Apparatus Using a Tribo-Electric Charging Technique," filed July 25, 1995) describe, *inter alia*, the electrostatic deposition of objects, such as particles of powder, on a substrate, such as an inhaler substrate. The foregoing patent applications are hereby incorporated herein by reference, in their entirety.

The present invention is directed, in part, to an inhaler apparatus with a substrate having medicament deposited thereon, the substrate being configured for electronic release of the medicament. In another aspect, the present invention provides a method for dispensing a medicant from an inhaler, comprising: (a) providing an inhaler with a substrate having a medicant deposited thereon, the substrate comprising a conductive layer and a dielectric layer and a voltage source connected to said conductive layer; and (b) actuating the voltage source.

Numerous approaches have been taken in the design and manufacture of dry powder inhalers. For example, WO 93/09832 discloses an inhalation device having an elongate carrier of medicament powder, the medicament powder being released after impact from a hammer, the inhalation device having a convoluted channel to deagglomerate the medicament powder.

The disadvantages of the inhalers of the prior art include, for example, the

inability of a patient suffering from a respiratory disorder, such as asthma, to inhale with sufficient force to receive an entire dosage. For example, a patient may only be able to generate an air flow rate of about 15 liters per minute. In most dry powder inhalers, the patient's inhalation supplies the energy required to dispense the medicament from the inhaler. The air flow rate generated by the patient's lungs significantly affects the amount of medicament that ultimately exits the inhaler and reaches the lungs.

Another disadvantage of the inhalers of the prior art includes the inability to accurately determine the amount of medicament dispensed, since the inhaler may dispense a greater or lesser amount of medicament, depending upon the patient's air flow rate, for example.

A further disadvantage of the inhalers of the prior art is a problem of agglomeration of the medicament powder. Agglomerated particles generally impact the mouth and throat rather than remaining in the air flow for deposition on the lungs. One of the approaches to remedying this problem has been the provision of tortuous channels in the inhalers of the prior art to promote deagglomeration. This approach suffers from drawbacks, however, such as the deposition of the medicament along the channels, thereby leading to inaccurate dosage dispensing.

Another disadvantage encountered in the inhalers of the prior art is unintended dislodging, in which the medicament is discharged, for example, upon dropping the inhaler.

For the foregoing reasons, there is a need for a dry powder inhaler capable of delivering an accurate unit dosage of medicament at a low flow rate, such as 15 liters per minute, yet which substantially retains the medicament upon impact, such as dropping the inhaler.

SUMMARY OF THE INVENTION

The present invention is directed, in part, to an inhaler apparatus comprising a substrate with a medicant deposited thereon, the substrate comprising a conductive layer and a dielectric layer thereon. In certain embodiments, the conductive layer comprises at least one wire embedded in the substrate, and in other embodiments, the conductive layer in the substrate has openings therein, such as a mesh. Preferably, the conductive layer is connected to a voltage source. Furth r, in certain pr f rred mbodim nts, the conductive layer comprises at least one floating

lectrode, and the medicant is preferably deposit d on the substrate in a pattern determined by the floating electrodes.

In preferred embodiments, the inhaler further comprises a second conductive layer positioned above the substrate without having contact with the substrate. Preferably, the second conductive layer has openings therein, and more preferably, the openings of the second conductive layer have a diameter of about 1.5 times the average diameter of the particles of medicant. In certain preferred embodiments, the voltage source is connected to the conductive layer in the substrate and the second conductive layer above the substrate. Preferably, the openings in the conductive layer in the substrate, when present, have a diameter approximately equal to the diameter of the openings in the second conductive layer above the substrate. Preferably, the openings of the second conductive layer have a diameter of about 1.5 times the average diameter of the particles of medicant.

In other preferred embodiments, the inhaler apparatus further comprises a third conductive layer positioned below the substrate, and the voltage source is preferably connected to the second conductive layer above the substrate and the third conductive layer below the substrate.

In another aspect, the present invention provides a method for dispensing a medicant from an inhaler, comprising:

(a) providing an inhaler with a substrate having a medicant deposited thereon, said substrate comprising a conductive layer and a dielectric layer and a voltage source connected to said conductive layer; and

(b) actuating the voltage source.

Preferably, the voltage source is actuated substantially simultaneously with air flow, and the actuation is preferably a pulse having a duration of about 300 microseconds to about 1 millisecond. The voltage used is preferably from about 500 to about 2000 volts.

BRIEF DESCRIPTION OF THE DRAWINGS

Figures 1A and B are a diagrammatic cross-section of one embodiment of a substrate having medicament deposited thereon, the substrate being configured for electronically assisted release of the medicament.

Figures 2A and B are a diagrammatic cross-section of another embodiment of a substrate having medicament deposited thereon, the substrate being configured for

electronically assisted release of the medicament.

Figure 3 is a diagrammatic illustration of an embodiment of the inhaler apparatus of the invention having an electronic release mechanism (not shown) powered by a battery.

Figure 4 is a graphical representation of 3 forces that adhere particles to the substrate of the inhaler; electrostatic forces ("Fe"), charge imaging forces ("Fim") and van der Waals forces ("Fv").

Figure 5 is a cross-sectional schematic view of an electrostatic chuck with floating electrodes on the upper conductive layer for charge imaging.

Figure 6 is a top view of a floating electrode of Figure 5.

DETAILED DESCRIPTION OF THE INVENTION

After depositing a powder onto a substrate of an inhaler, the powder is preferably accurately released upon inhalation by a patient. One of the obstacles to overcome is the adherence of the powder particles to the substrate. One of the forces holding the particles onto the substrate is a van der Waals force. Another holding force is the electrostatic force. A third holding force is a charge image force, generated by the charge of the powder particle in the local area of the substrate upon which it is adhered. These forces vary in magnitude depending upon, for example, the conductivity of the substrate. The van der Waals attraction increases over time, and the rate of increase is related to the rate of particle deformation due to greater contact area. See, for example, Figure 4, which is a graphical representation of mathematical calculations of the foregoing forces, and which shows that these forces increase as the particle size increases.

The above-described problems are addressed, among others, by the current invention. In one aspect, the present invention provides for inhalers with an electronic means for enhanced release of dry powders.

The electronic means for enhancing release is provided in preferred embodiments of the invention by a substrate of the inhaler comprising a conductive layer and a dielectric layer, the dielectric layer having contact with the powder deposited thereon. Preferably, the dielectric layer is sufficiently thick to prevent the substrate from adhering the powder too tightly, but also will prevent the powder from rel asing prematurely, such as due to the force of impact if the inhaler is dropped.

For example, in ord r for a powder particl having a charge:mass ratio of q/m

on a dielectric layer having a thickness d and dielectric constant ε_r to withstand a force of 500x gravity, ε_o being the dielectric constant of free space, and ignoring the van der Waals attraction, the following equation applies:

$$500x\ g \leq \frac{(q/m)^2 m}{4\pi\varepsilon_o\varepsilon_r d^2}$$

Assuming, for example, that q/m = 30 μC/g, m = 7 pg and ε_r = 2, d can be as large as 76 μm. In reality, the holding force will be stronger than 500x g due to the van der Waals attraction. The above equation can be used as a general guideline in determining the preferred thickness of the dielectric layer of the substrate.

The substrate of the inhaler has powder deposited thereon which is released upon inhalation. One means of powder deposition is ion printing, such as the technique described in Serial No. 08/471,889. Preferably, however, the substrate is not pre-charged prior to deposition of the medicament powder to attract the powder to the substrate. Instead, an electrostatic chuck is preferably used to electrostatically attract charged powder for deposition. For example, in certain preferred embodiments, the substrate itself forms an electrostatic chuck. Specifically, the conductive layer of the substrate has the configuration of an electrostatic chuck with floating electrodes for charge imaging, described in co-pending patent application Serial No. 08/630,050 (entitled "Electrostatic Chucks," filed April 9, 1996) which is incorporated herein in its entirety. The powder can be deposited on the substrate using an acoustic dispenser described in co-pending patent application Serial No. 08/630,049 (entitled "Acoustic Dispenser," filed April 9, 1996) which is also hereby incorporated herein by reference, in its entirety.

Briefly, an electrostatic chuck for charge imaging comprises three layers, preferably with an optional fourth layer. The bottom layer is the lower conductive layer, which is also known as the backing electrode. The second layer, on top of the lower conductive layer, is a dielectric layer. The third layer is an upper conductive layer on top of the dielectric layer, and this upper conductive layer has two types of electrodes, floating electrodes and shielding electrodes. In preferred embodiments, the floating electrodes are electrically isolated from the other conductors, and there is a gap between the floating and shielding electrodes. The fourth layer, on top of the upper conductive layer, is a dielectric layer, which is preferably the layer having

contact with th medicament powder, th thickness of this layer b ing the subject of the above mathematical formula. Preferably, this layer is made of polyimide or another material of high dielectric strength. Without being limited to a particular theory, it is believed that when a potential is applied across the shielding and backing electrodes, a charge redistribution occurs on the floating electrodes. This charge redistribution causes electrostatically charged objects to be attracted to the areas of the chuck corresponding to the floating electrodes, thus resulting in deposition in these areas. Preferably, there is a high fringing field in the gap between the floating and shielding electrodes, but this field is preferably not large enough to cause electrical discharge.

See, for example, Figure 5, which is a cross-sectional schematic view of an electrostatic chuck with floating electrodes on the upper conductive layer for charge imaging, Figure 6, which is a top view of a floating electrode of Figure 5. See also co-pending application U.S. Serial No. 08/630,050 "Electrostatic Chucks"), filed April 9, 1996, a continuation-in-part of which has been filed simultaneously herewith. Referring to Figure 5, for example, the chuck 1110 has a lower conductive layer 1120, with a dielectric layer 1130 on top of it. The dielectric layer has an upper conductive layer 1140 on top of it. The upper conductive layer 1140 is electrically connected, but with a gap 1150 between a shielding electrode 1160 and a floating electrode 1170. A top view of the upper conductive layer 1140 is shown in Figure 6, with the floating electrode 1170 in the center, and a gap 1150 between the floating electrode and the surrounding shielding electrode 1160.

The floating electrodes of the charge imaging chuck determine the pattern of deposition of the medicament powder on the substrate, and hold the powder thereon. During the deposition of powder, the charge imaging chuck is electrically connected to a power source, which is subsequently disconnected after deposition. The floating electrodes can be configured, for example, to spatially determine individual dosages on the inhaler substrate. For example, the conductive layer 100 of the substrate 101 illustrated in Figure 1 can be a charge imaging chuck. The conductive layer of this chuck can also be used for the electronically assisted release of powder according to the present invention.

Specifically, Figures 1A and B are a diagrammatic cross-section of a substrate 101 having medicament deposited thereon, the substrate having a conductive layer

100 and a dielectric layer 105. The surface 103 of the substrate 101 in contact with medicament 107 is preferably modified according to co-pending application, filed simultaneously herewith, entitled "Inhaler Apparatus with Modified Surface for Enhanced Release of Dry Powders." During assisted release, a conductive layer 109, illustrated as a mesh, is positioned above the substrate and a voltage is applied across these two conductive layers, as shown in Figure 1B.

Thus, according to one aspect of the present invention, upon inhalation by a patient, the powder is released from the inhaler using an electronic mechanism to assist release. Preferably, the conductive material in the substrate is subjected to an electric pulse.

In certain preferred embodiments, such as when the substrate is solid, in order to release the medicament from the substrate of the inhaler, a potential is applied to the conductive layer in the chuck. Preferably, a conductive material, such as a mesh, is placed above the substrate during release, without having contact with the substrate, and an electric potential is applied between the substrate and the mesh. See, for example, Figure 1B.

A high voltage pulse is applied across the mesh and the conductive layer in the substrate to trigger release. Preferably, the pulse is synchronized with and triggered by air flow due to inhalation. For example, the inhaler preferably has a switch that activates the pulse upon air flow due to inhalation. The activation is preferably a pulse having a duration of about 300 microseconds to about 1 millisecond. The voltage used is preferably from about 500 to about 2000 volts.

The substrate can alternatively include a conductive layer that is not a charge imaging chuck. For example, the substrate may have a conductive layer with multiple holes, forming a mesh. For release, a second conductive layer having holes therein can be placed above and below the substrate, without having contact with the substrate. An electrical connection between the two conductive layers above and below the substrate provides for electronically assisted release of the powder from the substrate. See, for example, Figure 2. Preferably, a conductive layer placed above or below the substrate is located from about 1 mm to about 2 mm from the substrate. During release, a high voltage pulse is applied across the two conductive meshes. Preferably, the pulse is synchronized with and triggered by air flow due to inhalation.

Figures 2A and B are a diagrammatic cross-section of a substrate 200 having

medicament 107 deposited th reon, the substrate 200 being a mesh. During assisted release, two conductive layers 202 and 204, illustrated as meshes, with holes therein, are positioned above and below the substrate and a voltage is applied across these two conductive layers, as shown in Figure 2B. When the substrate has holes therein, two conductive layers, one above and one below the substrate, are preferably used to release the medicament from the substrate. Without being limited to a particular theory, it is believed that the use of the two conductive layers with a potential applied across them, enhances the release of powder from the substrates with holes therein in an upward direction, toward the mouthpiece. Preferably, the thickness of the substrate is about 1 mil to about 30 mils.

When the conductive material of the substrate has holes therein, such as a mesh, the holes are preferably configured to maximize air flow so that a substantial amount of the powder is released, and in preferred embodiments, are from about 600 microns to about 2 millimeters in diameter. Preferably, the mesh is made of a metal, such as stainless steel, and the mesh is preferably coated with a dielectric, such as polytetrafluoroethylene ("TEFLON"). The mesh can be a part of the mouthpiece, for example, and is preferably aligned with a single dose prior to inhalation.

Alternatively, for example, the substrate of the inhaler, upon which the medicament is located, can have embedded therein a solid conductive material. For example, the substrate may have embedded therein a wire or multiple wires. Preferably, the conductive material is a metal.

The power source for the electronic assistance is shown in the context of an exemplary inhaler in Figure 3, which is a diagrammatic illustration of an embodiment of the inhaler apparatus of the invention having an electronic release mechanism (not shown) powered by a battery 303. In this embodiment, multiple air inlets 302 have channels 304 connected to each inlet to increase release of the powder from the mouthpiece 305. A shuttering mechanism 306 is provided for several of the air inlets 302. The mouthpiece 305 is in air flow communication with the substrate 307 having medicant deposited thereon (not shown). The substrate 307 is in the form of an elongated tape, which is provided by reel 308 and taken up by reel 309. The substrate has a seal (not shown) which is taken up by reel 310.

The electronic assistance of release can be combined with other mechanisms for promoting release, including but not limited to the use of a substrate having

grooved indentations to reduce the amount of surface area of the substrate in contact with the powder particles. Pr ferably, the substrate is modified as described in co-pending application entitled "Inhaler Apparatus with a Modified Surfaces for Enhanced Release of Dry Powders," which has been filed simultaneously herewith and is hereby incorporated by reference herein in its entirety.

It will be understood that the inhalers of the invention can be used with numerous types of medicaments, and in addition to oral administration, the inhalers of the invention can be used for nasal administration.

CLAIMS

We claim:

1. An inhaler apparatus comprising a substrate with a medicant electrostatically deposited thereon, said substrate comprising a conductive layer and a dielectric layer thereon.

2. The inhaler apparatus of claim 1, wherein the conductive layer is connected to a voltage source.

3. The inhaler apparatus of claim 1, wherein the conductive layer comprises at least one wire embedded in the substrate.

4. The inhaler apparatus of claim 1, wherein the conductive layer comprises at least one floating electrode.

5. The inhaler apparatus of claim 1, wherein the inhaler further comprises a second conductive layer positioned above the substrate without having contact with the substrate.

6. The inhaler apparatus of claim 1, wherein the conductive layer in the substrate has openings therein.

7. A method for dispensing a medicant from an inhaler, comprising:

(a) providing an inhaler with a substrate having a medicant deposited thereon, said substrate comprising a conductive layer and a dielectric layer and a voltage source connected to said conductive layer; and

(b) actuating the voltage source.

8. The method of claim 7, wherein the voltage source is actuated substantially simultaneously with air flow.

9. The method of claim 7, wherein the actuation is a pulse having a duration of about 300 microseconds to about 1 millisecond.

10. The method of claim 7, wherein the voltage is from about 500 to about 2000 volts.

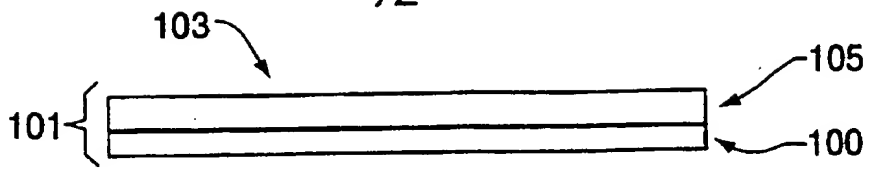


FIG. 1A

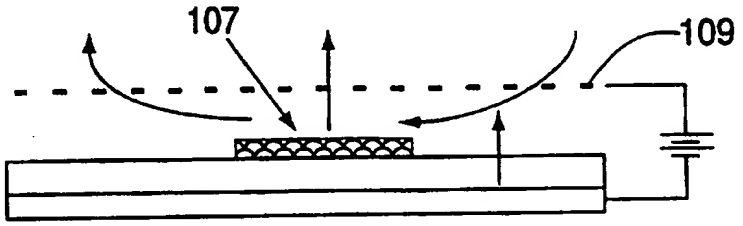


FIG. 1B

FIG. 2A

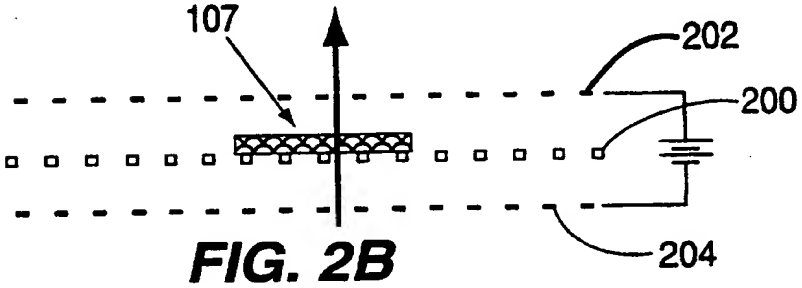


FIG. 2B

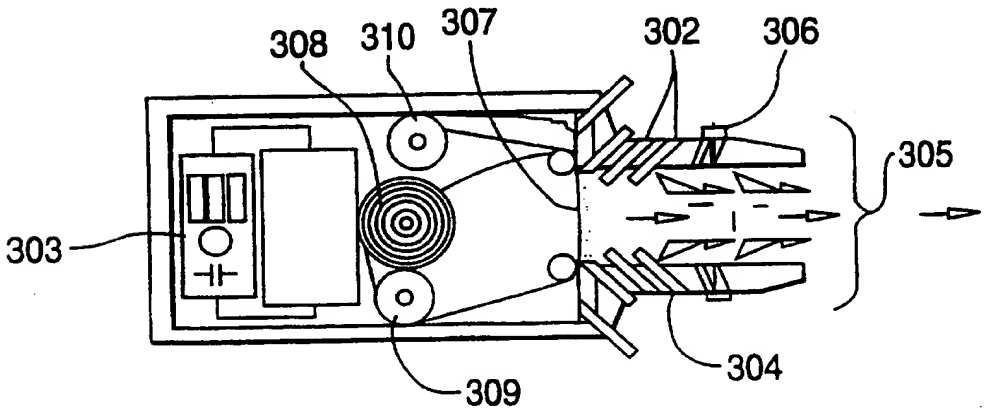


FIG. 3

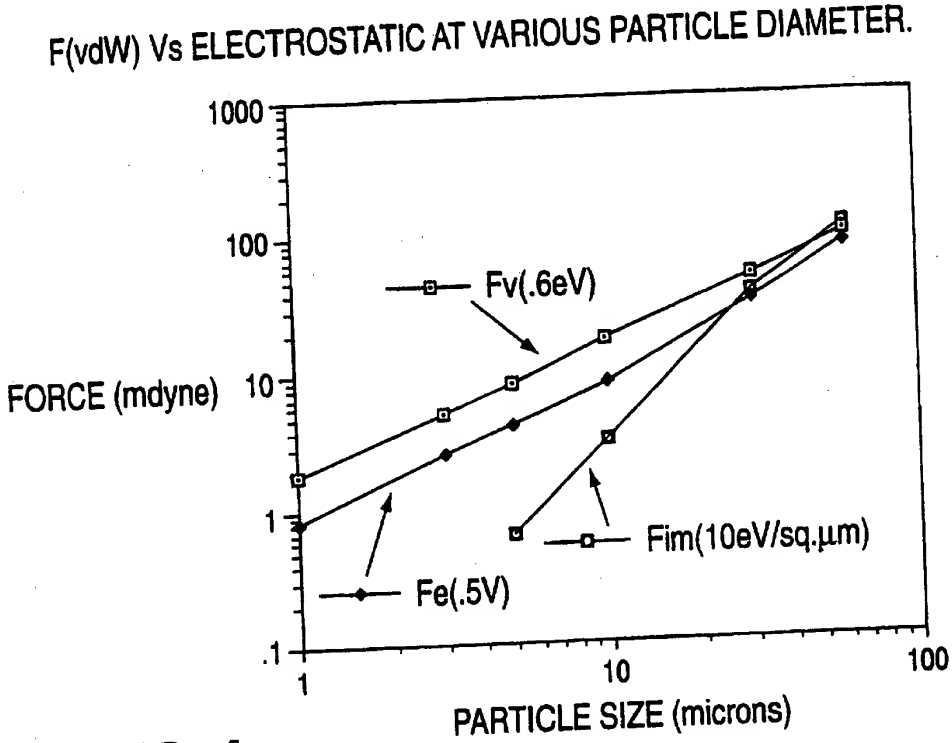


FIG. 4

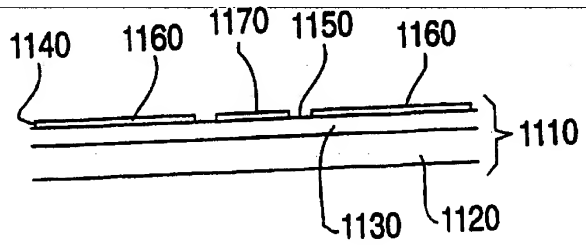


FIG. 5

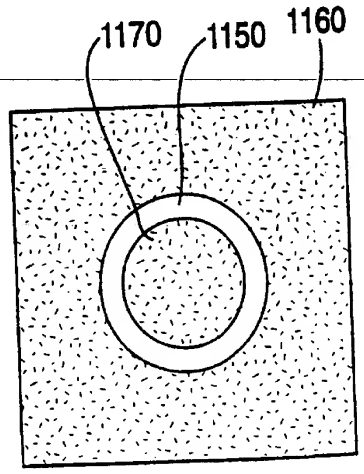


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US97/09301

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :A61M 15/00
US CL :128/203.12, 203.15, 203.21; 239/102.1, 102.2
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 128/203.12, 203.15, 203.21; 239/102.1, 102.2

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS
Search Terms: electrostatic chuck, inhaler atomizer, nebulizer, mdi

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y,P	US 5,619,984 A (HODSON et al.) 15 April 1997, entire document.	1-10
A	US 4,072,129 A (BRIGHT et al.) 07 February 1978, entire document.	1-10
A, E	US 5,642,727 A (DATTA et al.) 01 July 1997, entire document.	1-10
A	US 4,685,620 (LAW et al.) 11 August 1987, entire document.	1-10

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 18 JULY 1997	Date of mailing of the international search report 03 SEP 1997
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer WILLIAM DEANE Telephone No. (703) 308-2868

Form PCT/ISA/210 (second sheet)(July 1992)★